Before the

Federal Communications Commission

Washington, D.C. 20554

In the Matter of	)	
	)	
Unlicensed Use of the 6 GHz Band	)	ET Docket No. 18-295
	)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	GN Docket No. 17-183

COMMENTS OF TUCSON ELECTRIC POWER COMPANY AND UNS ELECTRIC, INC.

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I. SUMMARY

Pursuant to sections 1.415 and 1.419 of the Federal Communication Commission's ("Commission") rules,[1] Tucson Electric Power Company ("TEP"), jointly, with its affiliate company, UNS Electric, Inc., ("UNS Electric"), collectively referred to as the "Company,"[2] respectfully submit comments in response to the Commission's Notice of Proposed Rulemaking ("NPRM") in the above-mentioned proceeding. [3]

The Company appreciates the opportunity to comment in this proceeding. The Company supports the Commission's goal of promoting new opportunities for both licensed and unlicensed use of radio spectrum. The Company shares the Commission's view that increasing the availability of broadband connectivity to all Americans encourages technological innovation and contributes to economic growth. While the Company supports technological innovation, the Company does not support the unlicensed use of the 6 GHz band, without significant regulatory and interference mitigations mechanisms, to ultimately be codified in Part 15 of the Commission's rules.[4]

On August 3, 2017, the Commission opened the predecessor Notice of Inquiry ("NOI") to this proceeding.[5] TEP submitted comments opposing the unlicensed use of the 6 GHz band.[6] TEP incorporates its comments and objections herein. The Company supports the comments of similar-situated trade associations, such as Edison Electric Institute ("EEI"), the Utility Technology

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[1] 47 C.F.R. § 1.415 (1987); 47 C.F.R. § 1.419 (2011).
[2] UNS Energy Corporation ("UNS Energy") is the parent company of TEP and Unisource Energy Services ("UES"). UES is the parent company of UNS Electric, Inc. UNS Energy is a subsidiary of Fortis Inc., the largest investor-owned electric and gas distribution utility in Canada.
[3] *See* Unlicensed Use of 6GHz Band, 83 Fed. Reg. 64506-01 (proposed Oct. 24, 2018) (to be codified at 47 C.F.R. pt. 15) ("NPRM"); *See also* Expanding Flexible Use in Mid-Band Spectrum Between 3.7 & 24 GHz, 32 F.C.C. Rcd. 6373 (adopted Aug. 3, 2017) ("NOI").
[4] 47 C.F.R. § 15.401 (2014).
[5] *See NOI*, *supra* note 3.
[6] Tucson Electric Power Company, Comment to NOI (Oct. 2, 2017), https://www.fcc.gov/ecfs/filing/1002809323040 ("TEP NOI Comments").

Council ("UTC"), and Fixed Wireless Communications Coalition ("FWCC"),[7] and several utilities.[8]

The NPRM and NOI both recognize, the 6 GHz band is heavily utilized by critical infrastructure providers, government, and public safety.[9] Entities like the Company use this protected spectrum, on a primary basis, to provide vital services. Every citizen, organization, and business in the country profoundly relies on such entities being able to communicate without interruption or harmful interference – a fact the Commission explicitly highlights as it pertains to electric utilities in its concurrent docket.[10] Should the Commission move forward with this

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[7] Util. Tech. Council & Edison Electric Instit., Comment to NOI (Oct. 2, 2017) https://www.fcc.gov/ecfs/filing/1003208082289; Util. Tech. Council & Edison Electric Instit., Reply to Comment NOI (Nov. 15, 2017), https://www.fcc.gov/ecfs/filing/111563525734; Fixed Wireless Communications Coalition ("FWCC"), Comment to NOI (Oct. 2, 2017), https://www.fcc.gov/ecfs/filing/1002523216810; FWCC Reply to Comment NOI (Nov. 15, 2017), https://ecfsapi.fcc.gov/file/1115280042913/01118673.pdf; FWCC, *Ex parte* to NOI (Mar. 13, 2018), https://www.fcc.gov/ecfs/filing/1060813910692; FWCC, *Ex parte* to NOI (Mar. 30, 2018), https://www.fcc.gov/ecfs/filing/1033045477910; FWCC, Comment to NOI (May, 31, 2018), https://www.fcc.gov/ecfs/filing/1053181560289; FWCC, *Ex parte* to NOI (Jun. 8, 2018), https://www.fcc.gov/ecfs/filing/1060813910692; FWCC, *Ex parte* to NOI (Jun. 25, 2018), https://www.fcc.gov/ecfs/filing/10625160468361; FWCC, *Ex parte* to NOI (Jul. 17, 2018), https://www.fcc.gov/ecfs/filing/10717207604667; FWCC, *Ex parte* to NOI (Nov. 2, 2018),; FWCC, *Ex parte* to NOI (Nov. 15, 2018), https://www.fcc.gov/ecfs/filing/101523937820.

[8] *See* Duke Energy Corp., Comment to NOI (Oct. 2, 2017), https://www.fcc.gov/ecfs/filing/100281180033; Lower Colo. River Auth., Comment to NOI (Oct. 2, 2017), https://www.fcc.gov/ecfs/filing/1002142073229; Lower Colo. River Auth. Reply Comment to NOI (Nov. 15, 2017), https://www.fcc.gov/ecfs/filing/1115438213914, PacifiCorp, Reply to Comment NOI (Nov. 16, 2017), https://www.fcc.gov/ecfs/filing/111693950182; Pacific Gas & Electric Co. Reply to Comment NOI (Nov. 14, 2017), https://www.fcc.gov/ecfs/filing/1114996106568; Southern Co. Service, Comment to NOI (Oct. 2, 2017) https://www.fcc.gov/ecfs/filing/1003170317799; Southern Co. Service, Reply to Comments NOI (Nov. 15, 2017) https://www.fcc.gov/ecfs/filing/111627378595; Util. Tech. Council et, al. *Ex Parte* Presentation to NOI, (Jul. 27, 2018), https://ecfsapi.fcc.gov/file/1072827774513/UTC%20ex%20parte%207-27-2018.doc ("UTC *Ex Parte* 2018 Presentation").

[9] NPRM, *supra* note 3, at 64507; NOI, *supra* note 3, at 6376.

[10] *See* Public Safety & Homeland Sec. Bureau Seeks Comment on Improving Wireless Network Resiliency Through Encouraging Coordination with Power Companies, Docket No. DA-19-13

proposed rulemaking, despite several objections from critical infrastructure providers, the Company believes several requirements and protections will need to be implemented to mitigate any potential interference from unlicensed users.

II. TEP AND UNS ELECTRICAL OPERATIONS & USE OF 6 GHZ

TEP is a vertically-integrated utility that provides regulated electric service to approximately 426,000 retail customers. TEP's retail service territory consists of a 1,155 square mile area that includes a population of approximately one million people in the greater Tucson metropolitan area in Pima County, as well as parts of Cochise County, Arizona. In addition, TEP sells electricity at wholesale to other utilities and power marketers at locations in the southwestern United States. TEP owns approximately 2,797 MW of generating capacity. The Company also owns certain electric transmission facilities which are used primarily to transmit power generated at the Four Corners, Gila River, Luna, Navajo, Springerville, and San Juan generating stations throughout the Company's service territory. Is it also worth noting that while the Springerville Generation Station ("SGS") is operated and managed solely by TEP, SGS is jointly owned by two other western utilities. Collectively these utilities provide power to 17 million people across five (5) states, which include major population centers as well as rural areas.[11] TEP presently owns, or participates in, an overhead electric transmission system consisting of approximately 2,173 pole and/or circuit-miles of high voltage lines (rated 138 kV to 500 kV). TEP also operates a NERC-certified balancing authority area ("BAA") within Arizona and portions of western New Mexico.[12]

(released Jan. 3, 2019), https://www.fcc.gov/document/improving-wireless-resiliency-through-power-company-coordination.

[11] TEP 2017 IRP, *infra* note 12, at 202.

[12] Tucson Electric Power Company, *2017 Integrate Resource Plan* (Apr. 3, 2017), https://www.tep.com/wp-content/uploads/2017/04/TEP-2017-Integrated-Resource.pdf ("TEP

Operating a BAA requires communication with not only TEP's facilities, but also neighboring utilities, using 6GHz Part 101 licensed microwave network.

UNS Electric is an electric utility that provides retail electric service to approximately 98,000 customers in Mohave County in northwest Arizona and in Santa Cruz County in southeast Arizona. Substantially all of UNS Electric's customers are in the residential and commercial classifications. UNS Electric owns generating facilities with a combined rating of approximately 395 MW. UNS Electric's lines are interconnected to the adjacent Western Area Power Administration-Lower Colorado Balancing Authority Area.

The Company is subject to regulation by the Arizona Corporation Commission ("ACC") with respect to retail electric rates, the issuance of securities, affiliate transactions, the maintenance of books and records, and other matters. Also, many public utilities, including the Company, are required to comply with mandatory electric reliability standards overseen by such authorities as the Federal Energy Regulatory Commission ("FERC") and the North American Electric Reliability Corporation ("NERC").[13]

The Company's electrical operations rely heavily on over 1,000 linear miles of Part 101-licensed 6 GHz microwave that stretch from northern New Mexico, continuing down eastern Arizona, through Tucson, across the Phoenix metro area, and then up the western part of the state. Moreover, there are additional important 6 GHz microwave spurs controlling electric power to sensitive Arizona locations.

2017 IRP*"*); Tucson Electric Power Company, *2018 Action Plan Update* (Apr. 30, 2018), https://www.tep.com/wp-content/uploads/2018/06/TEP-Action-Plan.pdf.

[13] *See* FERC, *About FERC*, WHAT FERC DOES, (Aug. 14, 2018), https://www.ferc.gov/about/ferc-does.asp; *See* NERC, *Program Areas & Departments*, STANDARDS, https://www.nerc.com/pa/Stand/Pages/default.aspx (last visited Feb. 11, 2019).

As detailed in TEP's comments in the related NOI, the Company has no other spectrum option below 10 GHz, except for 6 GHz, for Part 101 point-to-point fixed operations.[14] The 6 GHz band is the only spectrum that has the propagation characteristics, available bandwidth, and resiliency to rain fade, to reliably communicate over the long paths that comprise the statewide network supporting the Company's electric operations. The Company's current 6 GHz fixed service Part 101 frequency authorizations fall exclusively within 5.925-6.425 GHz and 6.525-6.875 GHz, which correspond to the proposed U-NII bands 5 and 7 as described in the NPRM.

The Company uses the 6GHz spectrum to communicate with its facilities across the state of Arizona to ensure the following: supervisory control and data acquisition (often referred to as SCADA in the electrical industry); direct transfer trip protective relaying; energy management for generation load control ("system control"); telemetry; power line fault location; and communications with field crews during restoration and maintenance operations.

III. IMPACTS OF COMMUNICATIONS FAILURE TO GRID RELIABILITY

The Company is interconnected and interdependent with other utilities throughout Arizona and across the western United States. Each utility shares resources and infrastructure across multi-state regions, together achieving a critical balance between generation and demand for electricity. The coordination, management, and protection of these interconnected resources requires systems to react and communicate in just a few milliseconds for reliable operations. Consequently, utility requirements for communications network reliability and availability far exceed the robust standards most telecommunications users expect, or telecom carriers can provide.[15]

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[14] TEP NOI Comments, *supra* note 5.

[15] As stated above, TEP and UNS Electric, as applicable, must adhere to FERC, NERC, and ACC compliance requirements. *See generally U.S. Senate Comm. on Energy and Nat. Res.: Hearing*

Communication impairments or outages result in loss of protection and control of critical electric infrastructure. Such impairment can lead to localized blackouts and damage to distribution systems, which may among other things, have severe economic impacts. Due to the nature of electric operations problems in one part of the grid, may quickly spread, potentially causing damaging domino effects and electrical outages. In extreme cases, widespread regional brownouts and/or rolling blackouts can occur. During restoration and routine maintenance operations, it is also imperative that field crews are able to communicate with system control, without interference. If such communication network is impaired, the safety of the Company's field crews is at risk. Due to the remote nature of a significant amount of the Company's facilities, the Company cannot depend on cellular telephone service ("cellular service") to communicate with crews and system control. Moreover, cellular service may itself be unavailable due to electric outages. In addition to the safety concerns of the Company's field crews, such communication loss could result in delayed restoration efforts, increasing the likelihood of widespread outages.

The Company emphasizes that, if the 6 GHz spectrum it uses becomes unreliable due to harmful interference, and thus, communications, are lost or degraded, the Company's ability to provide electric service is immediately compromised, potentially impacting an area far beyond the Company's service territory.

IV. PART 101 EXPECTATION OF INTERFERENCE-FREE OPERATION

The Commission asks for specific input to protect primary, licensed users, from interference from unlicensed devices.[16] Should the Commission move forward with its proposal, it is vital that

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to Examine Blackstart (Oct. 11, 2018) (statement of Joy Ditto, President, Utilities Technology Council), https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=A4258422-CA58-472E-BB13-2D7601FC3921 ("Statement of Joy Ditto").

[16] NPRM, *supra* note 3, at 64513.

the existing protection criteria, firmly established in the Commission's rules, be the minimum standard for mitigating interference and protecting all incumbent users.[17] The Commission has long provided unambiguous guidance that Part 101 of the Commission's rules provides access to non-auctioned spectrum "on a first come, first served, interference-free basis."[18] The expectation of an interference-free operation has led utilities, like the Company, to collectively invest billions of dollars designing, building, and operating sensitive and critical 6 GHz wireless networks, governed and protected under Part 101 of the Commission's rules. Therefore, it is The Company's position that requirements for protection from harmful interference, from any authorized emitter, unlicensed or otherwise, must be consistent with the Commission's established criteria for protecting fixed-station Part 101 receivers.[19]

To date, the Automated Frequency Coordination ("AFC") system is the sole mechanism identified in the NPRM to prevent harmful interference from occurring. However, all discussions to date of such system are theoretical and have not been tested. While the Company is hopeful that such an AFC system will be effective, the details and approach contained in the NPRM, do not demonstrate that incumbents will receive the same protection that the prior coordination notice (PCN) process provides Part 101 incumbents today. The Company addresses below the additional requirements that it believes will be necessary to prevent harmful interference and mitigation of any interference, should it occur. It should be clear that even though the Company proposes

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[17] *See generally, infra*, note 21.
[18] *See* Wireless Telecomm. Bureau's Broadband Div. & Pub. Safety & Homeland Security Bureau's Policy & Licensing Div. Issue Declaratory Ruling on Microwave Frequency Coordination & Seek Comment of Portion of Petition for Declaratory Ruling Filed by the Fixed Wireless Commc'n Coal., Inc., 30 F.C.C. Rcd. 355, 355 (2015), https://www.fcc.gov/document/fwcc-microwave-coordination-declaratory-ruling-public-notice.
[19] *See* 47 C.F.R. §101.105(a)(5)(i) & (b) (2005).

requirements for the AFC system, it does so solely in an attempt to improve the protection mechanisms of the AFC system, not because it agrees it will provide sufficient interference protection. Further, such AFC system must be tested, over an extensive period of time, prior to allowing unlicensed use of this spectrum, as proposed in the NPRM. Accordingly, should the testing of the proposed AFC system determine interference does in fact occur and impact critical infrastructure operations, the Commission should re-evaluate its proposed rulemaking and prohibit any further unlicensed use of this spectrum.

V. INCUMBENT FIXED STATION RECEIVER PROTECTION CRITERIA

Today, primary Part 101 licensed users rely on the Telecommunications Industry Association's ("TIA") Telecommunications Systems Bulletin ("TSB") 10 criteria to ensure interference does not occur between users.[20] Due to the protections and process currently implemented, there is strong logic to maintaining TSB 10 as the protection mechanism for proposed unlicensed 6 GHz use. TSB 10 requirements are strongly embedded across the Commission's rules,[21] and have provided both long-standing reliable protection criteria, together with regulatory consistency for Part 101 users. Further, the TIA Committee TR-45 Working Group on Microwave Systems ("Working Group"), in conjunction with the Commission, the National Spectrum Management Association ("NSMA"), equipment manufacturers, Part 101 licensees, consulting engineers, telecommunications attorneys, and other interested parties periodically review appropriate licensed fixed station protection criteria, as advances in radio equipment, antenna systems, and user requirements evolve. This

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[20] *See generally* Telecomm. Inds. Ass'n, *TR-45 Mobile and Point-to-Point Communications Standards*, http://standards.tiaonline.org/all-standards/committees/tr-45 (last visited Jan. 22, 2019).

[21] *See* 47 C.F.R. § 22.602(j) (2006); 47 C.F.R. § 24.237(a) (2004); 47 C.F.R. § 27.1134(b) (2015); 47 C.F.R. § 101.3 (2013); 47 C.F.R. §101.79(a); 47 C.F.R. § 101.105 (2005); 47 C.F.R. § 101.79(a) (2013); 47 C.F.R. § 101.95(a) (2003).

review process has both facilitated technological innovation, while allowing a periodic reexamination of proper interference protection criteria to preserve reliable Part 101 fixed service operations.

Thus, all protection criteria, alternate propagation models, and interference prediction models should be presented to the TR-45 Working Group for evaluation and possible adoption into TSB 10, to avoid outcomes inconsistent with TSB 10. Once updated in TSB-10, such alternate criteria could then be incorporated into the AFC system or other frequency coordination mechanism that is consistent with the Commission's approach to interference protection. Coordination with the TR-45 Working Group would avoid situations that could allow different spectrum users to employ differing protection criteria, all aimed at protecting the same Part 101 incumbent.

The Company addresses the Commission's inquiry regarding the appropriate metric for noise power ratio and carrier interference.[22] The digital modulation is now almost exclusively used in Part 101 point-to-point microwave systems.[23] Therefore, consistent with the TR-45 Working Group draft replacement for TSB-10-F,[24] the threshold-to-interference (T/I), as described therein, should be the default criterion for digital radio systems. A single exposure limit of I/N = - 6 dB as the inter- and intra-system interference criterion (equivalent to a 1 dB receiver threshold degradation) should also be used. Such criteria are consistent with national and international

[22] Even though the Company is addressing the Commission's inquiry, all recommendations for protection criteria should be presented to the TR- 45 Working Group. NPRM, *supra* note 3, at 64509.

[23] The Company is assuming that unlicensed 6 GHz equipment is also likely to be exclusively digital.

[24] ARLINGTON: TELECOMMUNICATIONS INDUSTRY ASSOCIATION, ANSI/TIA Standard 10 (Excerpt), *Engineering Considerations for Fixed Point-to-Point Microwave Systems.* (*anticipated* Spring 2019) at Chapter 5, Section 5.1, Threshold to Interference (T/I) Criterion.

standards.[25] In further justification for the -6 dB exposure limit, the RKF Study in the predecessor NOI,[26] used such technical reference. The RKF Study was filed by several proponents of the unlicensed use of the 6GHz spectrum.[27]

VI. EXCLUSION ZONES & PROPAGATION MODELS

The NPRM inquires about requirements for exclusion zones for unlicensed devices.[28] As recommended by NSMA, primary Part 101 users should be evaluated and protected using an exclusion zone consisting of a three-dimensional, 250-mile main beam, +/- 5 degrees, along the azimuth from the boresight centerline of the incumbent fixed station receiver's antenna.[29] This criterion should be incorporated into the AFC system.

The Commission further inquires which propagation model is appropriate to determine the appropriate exclusion zones.[30] The Company objects to the use of propagation models to determine appropriate exclusion zones. Most digital microwave systems are designed using a free-space loss model, not propagation models. Propagation models only achieve average estimates in limited geographic areas. Such models rely on statistical averages, to estimate typical

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[25] Int'l Telecomm. Union, *ITU-R Recommendation F.758-6, System Parameters and Considerations in the Development of Criteria for Sharing or Compatibility between Digital Fixed Wireless Systems in the Fixed Service and Systems in other Services and Other Sources of Interference*, (Sept. 2015) at 9, Table 2, https://www.itu.int/dms_pubrec/itu-r/rec/f/R-REC-F.758-6-201509-I!!PDF-E.pdf.

[26] RKF Engineering Serv. LLC, *Frequency Sharing for Radio Local Area Networks in the 6 GHz Band* (Jan. 2018), Letter to NOI, Apple, Inc., *et al*. (filed Jan. 26, 2018) at 22-23 https://ecfsapi.fcc.gov/file/101261169015803/6%20GHz%20Ex%20Parte%20(Bureaus).pdf ("RKF Study").

[27] *Id.*

[28] NPRM, *supra* note 3, at 64509-10.

[29] *See* Nat'l Spectrum Managers, *Coordination Contours for Terrestrial Microwave*, Systems Recommendation WG 3.90.026 (Apr. 1992) https://nsma.org/wp-content/uploads/2016/05/WG3.90.026.pdf (last visited Jan. 17, 2019).

[30] NPRM, *supra* note 3, at 64509.

performance, with no knowledge or regard to the actual path profile or characteristics of the fixed link.[31] On the other hand, in support of the Company's argument, free space loss models arrive at acceptable fade margins with expected availability using known, actual path conditions and obstructions. Therefore, propagation models are not appropriate mechanism for achieving specific fixed receiver protection as required by Section 101.105 [32] Further, the International Telecommunications Union ("ITU") uses free-space loss for assessing impacts of unlicensed operations to fixed services,[33] rather than propagation models, such as the Commission presents in the NPRM.

Additionally, with respect to the Commission's observation that "a free space path loss model would effectively assume worst case conditions for every link," electric utilities are required to design and operate resilient networks under "worst case conditions." As recently discussed both with the Commission[34] and Congress,[35] it is one thing to operate under normal, day-to-day "blue sky" conditions, but quite another to perform reliably under difficult, dangerous circumstances, which by definition are "worst case." The public relies upon this resiliency to face and recover from adversity. In order to achieve this resiliency and reliability, the Company relies heavily on its 6 GHz microwave operations.

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[31] *See generally* McKenna, Paul & Hammerschmidt, Chriss, Institute for Telecommunication Sciences, *Propagation Measurement Workshop-Radio Propagation Models, ITS Boulder* (Jul. 28 2016) https://www.its.bldrdoc.gov/media/66385/propmeasworkshop3july282016.pdf.
[32] 47 C.F.R. § 101.105 (2005).
[33] Int'l Telecomm. Union, ITU-R Recommendation F.1706, *Protection Criteria for Point-to-Point Fixed Wireless Systems Sharing the Same Frequency Band with Nomadic Wireless Access Systems in the 4 to 6 GHz Range*, (2005) at 1, http://www.itu.int/dms_pubrec/itu-r/rec/f/R-REC-F.1706-0-200501-I!!PDF-E.pdf.
[34] UTC *Ex Parte* 2018 Presentation, *supra* note 7.
[35] Statement of Joy Ditto, *supra* note 15, at 3.

VII. AFC SYSTEM USE SHOULD BE MANDATORY

As proposed in the NPRM, if unlicensed co-channel operations are to coexist with existing licensed uses, the chief, crucial, and sole mechanism to reduce potential harmful interference will be a centralized AFC system.[36] Currently, the Commission is only proposing unlicensed users operating within 5.925-6.425 GHz and 6.525-6.875 GHz sub-bands (tentatively U-NII bands 5 & 7, if adopted in the NPRM) to register with the AFC.[37] As these bands correlate to the frequency ranges the Company extensively operates on, it agree that, at a minimum, unlicensed users must obtain an AFC registration and authorization for operation for these bands. However, the Company urges the Commission to require all 6 GHz sub-bands and all power levels to register with the AFC.

Recognizing there is a significant likelihood that devastating harmful interference from unlicensed 6 GHz operations will widely occur, if protection mechanisms to be achieved by the AFC system fail, the Company stipulates the AFC system must also be capable of assisting in identifying the source of and resolving harmful interference.

VIII. TECHNICAL REQUIREMENTS FOR AFC SYSTEM

The Company proposes the following functionalities and requirements of the AFC system:

1) Update from Universal Licensing System ("ULS") at least once every 24 hours a current database of Part 101 authorizations and applications. To avoid harmful interference, such

[36] *See* NPRM, *supra* note 3, at 64507-09.
[37] *Id.*

updates will accommodate and properly reflect new Part 101 applications and changes to existing authorizations;[38]

2) Accept real time requests from access points for unlicensed Part 15 frequency assignments, along with preferred occupied bandwidth;
3) Verify if the unique identifier of any access point is valid and properly registered before providing a frequency assignment or unique session identification number;
4) Perform calculations, per the required protection criteria to ensure new unlicensed devices do not cause harmful interference to protected, fixed service incumbents. Such protection criteria should include the 1 dB receiver degradation threshold with an I/N exposure limit of -6dB, as recommended by NSMA, using a free space loss model;
5) Provide access points a list of permissible operating frequencies *(or perhaps only a single assignment)*. Additional access point requirements will be addressed in Section X, below;
6) Log assigned operating frequency, authorized output power, and occupied bandwidth of access points to the AFC system;

[38] All Part 101 licensees have an obligation to keep information filed with the Commission current, accurate, and complete (47 C.F.R. § 101.133 (2003)). Accuracy of technical data is the foundation of frequency coordination and interference mitigation. For Part 101 licensees to expect protection from harmful interference, from any source, licensees must ensure their data in ULS is substantially correct. Therefore, in the event that a Part 101 licensee seeks enforcement action from the Commission, the licensee should attest their ULS data is accurate as part of the licensee's complaint. Where this is not the case, the licensee should be required to correct their information, prior to requesting enforcement action or interference mitigation from the AFC system. The threshold for determining whether the licensee's information is up- to-date, should be any change to the licensee's application that would qualify as a "major change" under the Commission's rules (47 C.F.R. § 1.929 (2015)). To encourage compliance and maximize the availability of spectrum, the Commission should open a filing window before the implementation of the AFC system, to allow incumbent licensees to make any updates or modifications to their information in ULS.

7) Assign a unique session authorization number associated with the access point's frequency assignment, and associate the unique session authorization number with the unique identifier of the access point and associated frequency assignments in the AFC database;
8) Provide each access point with the unique session authorization number, to be included as part of the access point's over-the-air identification;
9) Have the capability to cancel the unlicensed frequency assignment associated with a particular unique session ID and inhibit the associated access point from transmitting on the previously-assigned frequency;[39]
10) Be freely available online, at no cost, to the Commission, any Part 101 user, or other interested party for read-only queries;
11) Provide a web interface to permit standard database queries on unique session ID, frequency, geographic region, and/or unique manufacturer's Equipment ID that will provide all technical, geographic and user information associated with either the unique session ID or the unique manufacturer's equipment ID.

Notably, the Commission has similar registration requirements for automated spectrum management and interference mitigation for other shared spectrum approaches.[40] Thus, the Company contends the AFC system as described herein, is an extension of the Commission's recent strategies to achieve more effective spectrum sharing, while protecting incumbent, primary users.

[39] The Company proposes that such cancelation occur on a real time basis, similar to that under 47 C.F.R. § 96.39(c)(2) (2015).
[40] *Id.*; 47 C.F.R. § 15.711(c)(2) (2017); 47 C.R.F. § 96.59(a) (2015).

IX. AFC SYSTEM MUST BE CENTRALIZED

In response to the Commission's inquiry, the Company believes there should be a single, centralized, AFC system administrator.[41] The AFC system must be centralized to ensure the accuracy of information for Part 15 unlicensed frequency assignments. If multiple AFC systems exist, individual systems would conceivably have inconsistent information, diverging databases, and perhaps even employ different protection criteria – any of which could result in harmful interference to incumbent Part 101 users.

Such inconsistent information would greatly hinder and prolong efforts to resolve the interference, and potentially could lead to innocent Part 15 users being incorrectly identified as interferers or not identified at all from a database that is not up-to-date. Therefore, a sole, reliable system is required for both the authorization and identification of unlicensed 6 GHz frequency assignments. The Company is indifferent as to whether it is hosted on premises or in the cloud.[42] As long as the AFC system can protect incumbent 6 GHz primary uses and licensees, serve Part 15 users, is accessible in real time by the Commission and the public, the Company sees no advantage or detriment to either approach for its purposes under this NPRM.

X. AFC SYSTEM UNLICENSED FREQUENCY ASSIGNMENT FOR ACCESS POINTS

The Commission seeks detailed input regarding the AFC system and device registration.[43] The Company outlines the requirements of such frequency assignments. For protection of existing Part 101 users, certain information should only be provided by device hardware and not editable by

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[41] *See* NPRM, *supra* note 3, at 64508. The Commission has noted there is potential complexity with having multiple AFC operators needing to coordinate.
[42] NPRM, *supra* note 3, at 64507.
[43] NPRM, *supra* note 3, at 64508.

end users or other parties. The Company outlines the requirements of frequency assignments below. Any unlicensed 6 GHz access point must first initiate a frequency assignment request with the AFC system that includes:

1) Unique, immutable identifier of access point, which is typically the device's serial number assigned at time of hardware manufacture;
2) User and contact information (inputted by user);
3) FCC Registration Number (FRN), if available (provided by user);
4) Geographic location coordinates (using NAD 83) autonomously generated by the access point's GPS receiver (provided by device hardware);
5) Elevation (provided by device hardware);
6) U-NII operating band desired (either input by user or requested by hardware);
7) Intended occupied spectrum bandwidth (either input by user or requested by hardware); and
8) Directional or omnidirectional operation (preferably provided by hardware based upon integrated antenna design). If a directional antenna is used, the following additional information should be required:
    a. Centerline azimuth of directional antenna;
    b. Gain of directional antenna;
    c. Polarization of transmit antenna (vertical, horizontal, circular, cross-polarized/MIMO transmit, etc.);
    d. The -3 dB beamwidth of transmit antenna in degrees; and
    e. Receive access point's unique, immutable identifier (inputted by the user).

In the event the access point is unable to communicate with the AFC system for frequency assignment, it should be forced to cease operations entirely within the 6 GHz band.

XI. DEVICE ENABLEMENT & OPERATIONAL LIMITATIONS

The Company asserts all unlicensed client devices operating at 6 GHz should be under the control of an access point at all times, with a valid and current frequency assignment, from the AFC system. This is largely consistent with the Commission's proposal.[44]

If a non-interfering channel is available, the AFC system will have issued the access point a unique session identification number that will be included in the access point's over-the-air identification, along with channel assignment(s). Within the access point, by default, all frequencies not explicitly authorized by the AFC system, should be automatically disabled and blacklisted for transmission. If an access point does not have a current and valid unique session identification number from the AFC system, it will automatically and immediately become inhibited and incapable of transmitting on any frequency in the 6 GHz band. Any affiliated client devices will also be inhibited from transmission. Such inhibition must not be bypassed or disabled. Unique session identification numbers must be renewed by the access point via the AFC system at least once every 24 hours. Renewing the unique session identification will protect new Part 101 frequency assignments, better manage Part 15 use of the 6 GHz spectrum, and ensure the AFC database remains current and useful.[45] In sum, under no circumstances should a client device be permitted to operate without the control of an access point, on an ad hoc basis, or establish peer-to-peer operations between other subscriber devices. Client devices should have the same over-the-air identification requirements as access points. In addition, for identification and interference

[44] *See generally* NPRM, *supra* note 3, at 64510-11.
[45] This requirement is addresses the Commission's inquiry. NPRM, *supra* note 3, at 64510.

resolution, the same unique session identification information as the controlling access point should be combined with the client device's unique equipment ID.

XII. OVER-THE-AIR IDENTIFICATION REQUIREMENTS

The Commission asks whether access points in the 6 GHz band should be required to transmit digital identifying information.[46] This should be required and should be a unique identifier associated with each station. Such information will be key to identifying and resolving harmful interference to critical Part 101 users.

In the NOI, most of the proponents of unlicensed use appear to intend on using the 6 GHz band for and extension of WiFi services under some variation of the Institute of Electrical and Electronics Engineers (IEEE) 802.11 standards.[47] For the station identification of co-channel 6 GHz unlicensed operations as proposed,[48] IEEE 802.11 provides an apparent, ready-made mechanism to achieve this compliance requirement. Furthermore, such unique over-the-air identifiers should be incorporated into and captured by the AFC system. IEEE 802.11-based access points, periodically transmit a beacon frame – often as frequently as every 100 milliseconds, to assist WiFi users in determining whether service is available or not, and is transmitted in an unencrypted, plaintext format that is easily to detect and identify over the air. [49] The beacon frame transmits, as part of its Basic Service Set (BSS), the following information that is relevant:

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[46] NPRM, *supra* note 3, at 64513.

[47] *See* All Points Broadband, et. al, Comments to NOI (Oct. 2 2017) https://www.fcc.gov/ecfs/filing/10030766909973; Wi-Fi Alliance, Comments to NOI (Oct. 2, 2017) https://www.fcc.gov/ecfs/filing/1002166917389; IEEE 802 Comments to NOI (Oct. 2, 2017) https://www.fcc.gov/ecfs/filing/1002043724729.

[48] NPRM, *supra* note 3, at 64513.

[49] Cisco Systems, Inc., *802.11 Fundamentals* (Sept. 4, 2014) https://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Borderless_Networks/Unified_Access/CMX/CMX_802Fund.pdf.

1) The BSS identifier, a unique, immutable identifier assigned at time of manufacture;
2) Channel the specific center frequency that the access point is operating on; and
3) Channel width.

To achieve the capabilities and functionality of the AFC system, and to assist with interference identification and mitigation, the IEEE 802.11-beacon frame standard needs to be incorporated into the unique session authorization number, generated by the AFC system, at the time of frequency assignment. Therefore, the Company submits the IEEE 802.11 beacon frame provides an expeditious and efficient way to achieve over-the-air identification for unlicensed devices.[50] Such standard has most of the characteristics and information needed in a standardized format for incorporation into the AFC database. Such information will assist in finding the owner, appropriate contact information, and authorized operation parameters of the access point. Furthermore, when harmful interference occurs, this information will greatly assist in resolving the interference, protecting licensed operations in the 6 GHz band.

The Commission already requires many licensees operating under a broad array of its rule sections to transmit a unique identifier, including broadcast radio services,[51] amateur operations,[52] as well as land mobile radio services.[53] Therefore, over-the-air identification requirements are well established across the Commission's rules and are easily implemented, using current technology and industry standards.

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[50] In the event that non-WiFi/IEEE 802.11 compliant equipment is used, the same over-the-air station identification requirements should apply. Such identification should be in plaintext, transmitted in a standardized, agreed upon format, that is easily captured and demodulated over the air using standard monitoring equipment.
[51] 47 C.F.R. § 73.1201 (2011).
[52] 47 C.F.R. § 97.119 (2011).
[53] 47 C.F.R. § 90.425 (2017).

XIII. FEES & COSTS FOR AFC SYSTEM ACCESS

We agree with the Commission's assessment that fees may be charged for providing registration and channel availability functions.[54] However, charging fees for access to the AFC system for the purposes of identifying and resolving harmful interference is not reasonable or appropriate. In the case of Part 101 users, there is a significant financial cost involved in obtaining protected frequency assignments through the PCN process. Part 101 users should not now also have to pay to protect their frequency assignment, if the expended the time and money to try and ensure that protection through the PCN process at the outset. Furthermore, to obtain the primary frequency authorizations, there are fees paid to the Commission for non-government application.[55] Part 101 users obtain no benefit from the AFC system, other than using it to resolve harmful interference.

Part 15 unlicensed users obtaining frequency assignments via the AFC system should be required to pay any fees associated with maintaining the AFC system. In order for the AFC system to be viable and reliable, some mechanism must exist to fund and sustain it. However, such fees should be as minimal as necessary. Whether these fees are charged for individual AFC frequency assignments, to user groups, industry associations, or to equipment manufacturers, is a matter best left to the proponents of the unlicensed 6 GHz use. Nonetheless, current licensed Part 101 incumbents should not be responsible for paying fees of any kind.

XIV. RESTRICTIONS ON EXTERNAL ANTENNAS FOR UNLICENSED OPERATIONS

[54] NPRM, *supra* note 3, at 64509.
[55] 47 C.F.R. § 101.133 (2003).

The Company firmly believes the use of external antennas (non-integrated) and external antenna connections should be prohibited for unlicensed equipment operating within 6 GHz. Given the availability of extremely high-gain antennas in this band, it would be trivial to connect a low-power Part 15 device and significantly exceed the authorized equivalent isotropically radiated power ("EiRP") limits both under the proposed limits in the NPRM, as well the limitations assigned to the station by the AFC system. The AFC system has no way to account for external gain and actual EiRP, other than relying upon the end user or installer to correctly input this information.[56] Conversely, the unlicensed user could subsequently swap the antenna for a higher-gain model and/or reorient the antenna to a different azimuth, which the AFC system could not contemplate or detect.

Past strategies in the U-NII bands 1-3 to prevent unauthorized EiRP levels ultimately failed. Under Section 15.407(a)(3), users have found workarounds to include the use of high-gain antennas without EiRP restrictions.[57] Therefore, The Company strongly recommends the Commission require all unlicensed equipment, operating across the 6 GHz band, have integrated and non-changeable antennas. Also, in the factory, manufacturers should be required to fix and limit the maximum conducted power of the equipment. This will guarantee the maximum possible EiRP of the device will never exceed the limits of §15.407(a)(4) when adopted.[58] Such limitation would ensure field modification is impossible. By prohibiting external antenna connections, the Commission accomplishes its objectives, while protecting licensed users, and avoiding what will otherwise be frequent interference mitigation and enforcement actions.

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[56] Assuming correct information, the AFC system could make a valid frequency assignment using the parameters provided.
[57] 47 C.F.R. § 15.407 (a)(3) (2016).
[58] *Id.* at (a)(4).

XV. RESTRICTIONS ON POINT-TO-POINT AND HIGH-POWER PART 15 USE AT 6 GHZ

The Company believes point-to-point unlicensed communications and high gain antennas at 6 GHz should be expressly prohibited. The Company seeks the Commission's clarification regarding the proposed operations in the 5.925-6.425 GHz and 6.525-6.875 GHz sub-bands. For U-NII bands 5 and 7, it appears the Commission intends access points to operate as controlling base stations to client devices point-to-multipoint topology.[59] In further support of this interpretation, the Commission states "we are proposing no provisions for high gain antennas for unlicensed devices."[60] However, in the same paragraph, the Commission seeks comment "whether higher power operations could be permitted in rural and underserved areas under certain conditions" in U-NII bands 5 and 7, and whether such operations should be under the control of an AFC system.[61] The Company outlines its rural operations below and justifications for not allowing high gain antennas in rural locations.

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[59] The NPRM states, ". . . [W]ill use omnidirectional or wide beamwidth antennas (such as 60 or 120 degrees), rather than the highly directional antennas employed by fixed microwave services. *See* Unlicensed Use of 6GHz Band, Docket 18-295, (proposed Oct. 24, 2018) (to be codified at 47 C.F.R. pt. 15) at ¶ 56.

[60] *Id.* at ¶ 79.

[61] The proposed section §15.407(a)(4) appears consistent with the Commission's stated intent in Paragraph 56. However, the "certain conditions" language of Paragraph 79, together with the Commission's inquiry in Paragraph 81 that could allow antennas with a greater gain than 6 dBi, seem to indicate that directional, high EiRP operations from unlicensed devices could be allowed. This combined with the Commission's original language in Paragraph 20 which states, "we propose to permit only "standard-power access points"—using power levels permitted for unlicensed use in the U-NII-1 and U-NII-3 bands" leads to additional confusion as to the Commission's intentions on this subject. Part §15.407(a)(3) of the current Commission's Rules for U-NII-3 explicitly states that "fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power." *Id.*

Over vast stretches of some of the most rural areas in both Arizona and New Mexico, the Company, and many others, have not been able to obtain new Part 101 frequency assignments at either 5.925-6.425 GHz and 6.525-6.875 GHz through the PCN process. This is due to current congestion and full spectrum utilization across these 6 GHz bands from incumbent Part 101 licensees. It is inconceivable and improbable that high-power unlicensed users employing an AFC system will: (1) find non-interfering frequency assignments; (2) coexist; and (3) protect Part 101 incumbents from harmful interference, when similar primary assignments are not obtainable through the PCN process. Additionally, though this interference might only occur in rural areas, the devastating impacts are not localized to the point of interference. For the Company, interference in rural areas is both more devastating and harder to remediate than interference in urban areas. Operationally, these 6 GHz fixed microwave networks connect critical infrastructure spanning hundreds of miles between endpoints. If an outage occurs in a remote, rural area, the entire network is impacted, affecting distant operations at both ends of the network, from where the microwave links are typically monitored and controlled.

In the event of an outage or interference, it is generally impossible to conclusively determine the cause from the remote control point and logically impossible to resolve without dispatching technicians to the affected sites - which for many locations takes several hours or more to reach, assuming that weather conditions allow for site access. In the meantime, control mechanisms that protect and manage significant parts of the electric grid could be significantly compromised. If such impairments occur, not only could electric outages result, but utilities like the Company may have regulatory obligations required by FERC, NERC, and/ or the ACC.

In sum, the Company asserts that high-power co-channel unlicensed use in the 5.925-6.425 GHz and 6.525-6.875 GHz sub bands (proposed U-NII bands 5 and 7) should not be permitted to provide rural service or for any other operations.

XVI. ISLANDED UNLICENSED OPERATIONS

Unlicensed operations at 6 GHz that do not have access to an AFC system and are essentially "islanded" and should be prohibited from unlicensed operations and not be permitted under the Commission's Rules.[62] "Islanded networks" are those networks that are created for security or other reasons without any connection to the outside world. These networks typically perform for the purpose they are designed, but are unaware of anything that occurs beyond their bounds.

As a regulated utility with significant obligations to prevent cyberattacks, the Company understands why certain networks must be "islanded" for security or other reasons. Indeed, the Company uses this approach for several applications. However, if access points cannot access the outside world, they obviously cannot access the AFC system either for: (1) initial frequency assignments; (2) requirements to change channel or cease operation; (3) or to provide needed information for interference resolution. This will create a serious potential for incorrect frequency assignments, resulting in harmful interference that will be impossible to resolve without field enforcement action. Therefore, islanded operations should not permitted.

XVII. CYBERSECURITY CONCERNS

At present, it is possible to attempt to compromise a Part 101 point-to-point microwave communications link by unlawfully causing intentional harmful interference. However, to do so requires access to specialized radio equipment and antennas, not commonly available to the public.

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[62] NPRM, *supra* note 3.

Conversely, unintentional interference from Part 15 devices is almost unheard of today. Yet, in the near future, if the NPRM is ultimately adopted, hundreds of millions of unlicensed devices will operate in the United State alone.[63] Depending upon whether these devices allow for field reconfiguration and whether external antenna connections are permitted, new Part 15 unlicensed devices could become vectors to disrupt communications, possible even in an attempt to attack the electrical grid. Such users will be exceedingly difficult to identify and remediate against a backdrop of thousands other Part 15 users in a given geographic area.

For critical communications networks this will be akin to a Denial of Service (DoS) attack. The attacker would not need to know anything about the victim's network, beyond the public information contained in ULS. No passwords, authentication, or physical access to the victim's facilities would be required. From miles away using a high-gain directional antenna, the attacker could simply intentionally cause interference that would cause the victim's network to fail. Given the vulnerabilities created by unlicensed 6 GHz use, the Company strongly recommends the Commission work with critical infrastructure providers, FERC, the U.S. Department of Homeland Security, and the public safety community to develop strategies and mechanisms to prevent, detect, and mitigate these attacks, before adopting any rules permitting unlicensed operations as envisioned under this NPRM.

XVIII. INFORMATIONAL REQUIREMENTS

The Commission seeks comments on whether manufacturers should be required to provide consumers with specific operational requirements for operating in the U-NII-5 through U-NII-8

[63] RKF Study, *supra* note 26.

bands to prevent harmful interference.[64] We strongly urge the Commission to mandate such requirements. All requirements must be clearly and prominently communicated to end users in multiple ways. Considering from both an enforcement and liability standpoint, the unlicensed operator of the Part 15 device, rather than the manufacturer or content provider, is the party most likely to be held responsible for harmful interference to licensed, primary 6 GHz operations. Thus, such liability must be communicated, in the clearest possible manner, to consumer purchasing client devices.

The Company is unaware of any other paradigm where so many simultaneous unlicensed users who are: (1) unfamiliar with their obligations under the Commission's rules; (2) lack the experience and skillset to technically evaluate their emissions or mitigate interference; and (3) have the potential to disrupt so many mission-critical, protected operations. The technical and sophisticated network of microwave communications are far beyond what most laypeople have ever experience or are expected to understand.

We recommend that not only should devices themselves be labeled, but external packaging and user manuals clearly communicate the requirements, limitations, user obligations, enforcement penalties, and possible civil liability of the user for any unauthorized operation, harmful interference caused, or for any other violation of the Commission's rules. These warnings should be as prominent and ominous as those from the U.S. Surgeon General for tobacco products.[65]

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[64] NPRM, *supra* note 3, at 64513.

[65] U.S. Dept. of Health & Human Serv., Surgeon General, https://www.surgeongeneral.gov/index.html (last accessed Feb. 6, 2019).

XIX. INTERFERENCE RESOLUTION AND ENFORCEMENT MECHANISMS

The Commission's strategy for identifying and resolving harmful interference, including actions by the Enforcement Bureau to initiate field investigations and abate unlawful operations, has changed in recent years. Today, the Enforcement Bureau has far fewer field offices, relying instead upon remote spectrum monitoring, and on-call "Tiger Teams" that respond within 24 hours of an interference crisis, with prepositioned equipment around the country to assist with these mitigation efforts.[66] While we applaud the Commission's efforts at innovation and enthusiastically support and appreciate the Enforcement Bureau's activities to abate harmful interference, the prospect of co-channel, unlicensed 6 GHz operations and potential interference to sensitive, critical communications systems, which are relied upon to protect the electric grid within milliseconds, has led the Company to reexamine the enforcement current framework. In light of the NPRM, the Company recommends the Commission establish an expedited reporting and identification process that will give critical infrastructure providers fast-track access to Enforcement Bureau resources. These interference cases should receive the same priority and urgent response, as those causing a public safety emergency. Additionally, Part 101 users need to be able to coordinate with the Enforcement Bureau and initiate field investigations of harmful interference to utility communications, prior to the arrival of Enforcement Bureau personnel. This should include a mechanism to compel the operator of any Part 15 device, believed to be causing harmful interference, to immediately cease operations in the 6 GHz band. Therefore, independent of the regulations ultimately adopted for unlicensed operations, the Company believes closer

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[66] To date, the Commission only has three field offices that cover the United States. F.C.C., *EB - Regional and Field Offices*, https://www.fcc.gov/eb-rfo (last accessed Feb. 6, 2019); Inside Radio, *FCC Closes Nearly a Dozen Field Offices* (Aug. 29, 2016) http://www.insideradio.com/free/fcc-begins-closing-nearly-a-dozen-field-offices/article_1f4ef3fa-6dad-11e6-89c4-0b91ac43889d.html.

coordination between the electric utility industry and the Commission is needed to protect critical national infrastructure and the delivery of reliable energy to the public.

XX. INTERNATIONAL CONCERNS/ABSENCE OF U.S. MEXICO BILATERAL AGREEMENTS

The Company is concerned that expanded terrestrial broadband operations might produce harmful interference in the U.S.-Mexico border area, absent adequate protocols and enforcement mechanisms to protect spectrum users in each country. No bilateral agreement currently exists between the United States and Mexico for sharing or allocating the 6 GHz band for either terrestrial point-to-point or point-to-multipoint communications for licensed operations or otherwise. As such, independent of what is ultimately adopted by the Commission through this NPRM or any other proceeding, Mexico is theoretically free to assign and use the spectrum for any purpose it chooses, without considering the impacts to any user within the United States.

Once the 6 GHz band is opened for Part 15 unlicensed use, such equipment and/or client devices will quickly and inevitably make way across the border for use within Mexico, as well as for cross-border communications. This is pervasive today across the existing U-NII bands 1-3, with users on both sides of the border employing transmitters, amplifiers and high-gain antennas to achieve EiRP levels far in excess of existing Part 15 limits, as well as those proposed in the NRPM. Absent limits and enforceable mechanisms to the contrary, it must be assumed that in the border area, this will occur within the 6 GHz band. Such devices operating in close proximity to the U.S. Mexican border will cause devastating interference to U.S.-licensed Part 101 receivers - especially those of public safety and critical infrastructure.

The Commission’s recent experience and resulting delays in implementing Band 14 at 700 MHz for FirstNet deployment along the entire U.S.-Mexico border illustrates the challenges

involved with allotting and protecting spectrum for incumbents in the border region when bilateral agreements are not in place, or do not correspond to current spectrum uses and band plans.

As such, for the purposes of the NPRM and in an effort to protect U.S. Part 101 licensees generally, it is urgent that the Commission's International Bureau and the U.S. Department of State immediately begin to identify bilateral protection mechanisms and emissions limits for unlicensed 6 GHz use on both sides of the border that would, at a minimum, achieve the same protection mechanisms that ultimately flow out of the NPRM.[67]

Considering that for frequencies below 15 GHz in the United States, coordination and protection interference potential are assessed at distances up to 125 miles in all directions and 250 miles along the main beam +/- 5 degrees from the boresight centerline of the antenna,[68] achieving protection for respective primary authorizations in the U.S.-Mexico border region, especially from unlicensed 6 GHz co-channel operations assuming the limits specified in the NPRM, seems to be a tall order.

XXI. CONCLUSION

The wireless industry expects heavy unlicensed use of 6 GHz if the Commission ultimately adopts this NPRM, with 1.5 billion devices in operation in the continental United States by 2025.[69]

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[67] From a technical standpoint, an extension of the AFC system might provide a solution for compliant unlicensed operations on both sides of the border, if such an agreement could be reached with Mexico. This would also require establishing a mechanism for assigning and protecting primary spectrum assignments, similar to what governs other spectrum assignments along the common border. For other bands, this is achieved either through exclusion zones and protected allotments for each respective country, or by using an international coordination and notification process for discrete, authorized assignments.

[68] *See* Nat. Spectrum Managers, *Coordination Contours for Terrestrial Microwave Systems, Recommendation WG 3.90.026* (Apr. 1992) https://nsma.org/wp-content/uploads/2016/05/WG3.90.026.pdf (last visited Jan. 17, 2019).

[69] RKF Study, *supra* note 26.

At this density, even small missteps quickly magnify and broadly propagate. While the Company supports technological innovation, the Company does not support the unlicensed use of the 6GHz band, due to the potential for harmful interference with the operations of licensed, critical infrastructure providers. However, if the Commission decides to allow such unlicensed use, the Company believes several requirements and protections will need to be implemented to prevent and mitigate any potential interference from unlicensed users. The Company recognizes that while the AFC system is a theoretical solution that promises to prevent interference, it submits such system should be tested extensively prior to the Commission moving forward with unlicensed use of the 6 GHz spectrum. Such a system should reliably, show conclusive, unambiguous, effectiveness, demonstrating that interference cannot occur to 6GHz incumbents. In addition, for Part 15 users, high gain directional antennas should not be allowed. In the cases when interference occurs, better access to the Enforcement Bureau resources will be required.

(Continued)

Consequently, the Company asks the Commission to proceed with great caution in this matter, paying particular attention to the collective experience and strong concerns voiced in this proceeding by the electric industry and other 6 GHz incumbents who serve the public.

Respectfully Submitted,

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